

Claims

1. A magnetic field generator for magnetron plasma,
comprising a plurality of magnetic segments provided on the outer side of a
5 process chamber for performing a predetermined process on a substrate
placed in said chamber for generating a multi-pole magnetic field along the
circumference of said substrate, characterized in that the arrangement is
such that a strength of said multi-pole magnetic field in said process
chamber can be controlled.
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2. A magnetic field generator as claimed in claim 1,
characterized in that first ones of said plurality of magnetic segments are
rotatably mounted so that their directions of magnetic fields can be altered
and in that second, remaining ones of said plurality of magnetic segments
15 are stationary magnetic segments.
3. A magnetic field generator as claimed in claim 2,
characterized in that the magnetic fields of said stationary magnetic
segments are pointing to a circumferential direction relative to the center of
20 said process chamber.
4. A magnetic field generator as claimed in claim 2,
characterized in that the magnetic fields of said stationary magnetic
segments are pointing to the center of said process chamber.
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5. A magnetic field generator as claimed in any of claims 2 to 4,
characterized in that said plurality of magnetic segments are arranged in the
shape of a ring and in that a magnetic ring is provided on the outer side of
said magnetic segments.

6. A magnetic field generator as claimed in any of claims 1 to 5, characterized in that said magnetic field generator comprises an upper magnetic field generating mechanism and a lower magnetic field generating mechanism and in that said upper and lower magnetic field generating mechanisms are arranged to move vertically relative to each other.

7. A magnetic field generator as claimed in any of claims 1 to 6, characterized in that each of said magnetic segments is substantially in the shape of a cylinder.

8. A magnetic field generator as claimed in claim 1, characterized in that said magnetic field generator comprises an upper ring-shaped magnetic field generating mechanism and a lower ring-shaped magnetic field generating mechanism, and each of the upper and lower ring-shaped magnetic field generating mechanisms is provided with the magnetic segments each of which is rotatable about an axis extending to the center of the upper and lower ring-shaped magnetic field mechanisms.

9. A magnetic field generator as claimed in claim 8, characterized in that the arrangement is such that when the magnetic field generator is set in a first state the circumference of said substrate is surrounded by a multi-pole magnetic field of predetermined strength and when the magnetic field generator is set in a second state the circumference of said substrate is not surrounded by a magnetic field.

10. A magnetic field generator as claimed in claim 8, characterized in that said magnetic field generator comprises an upper ring-shaped magnetic field generating mechanism and a lower ring-shaped

magnetic field generating mechanism, and one or both of said upper and lower ring-shaped magnetic field generating mechanisms are arranged to rotate about the center axis of the upper and lower ring-shaped magnetic field mechanisms.

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11. A magnetic field generator as claimed in any of claims 8 to 10, characterized in that said magnetic field generator comprises an upper ring-shaped magnetic field generating mechanism and a lower ring-shaped magnetic field generating mechanism, and each of the upper and lower ring-shaped magnetic field generating mechanisms is provided with the magnetic segments, and the upper and lower ring-shaped magnetic field generating mechanism are arranged to move in vertically opposite directions to each other.

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12. A magnetic field generator as claimed in any of claims 8 to 11, characterized in that each of said magnetic segments is in the shape of a polygon or a circle in cross section.

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13. A magnetic field generator as claimed in claim 1, characterized in that a conductive ring is provided between said process chamber and said magnetic field generator and in that said conductive ring is arranged to rotate about the center of the conductive ring.

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14. A magnetic field generator as claimed in claim 13, characterized in that the speed of rotation of said conductive ring is controllable.

15. A magnetic field generator as claimed in claim 1, characterized in that the strength of said multi-pole magnetic field within

said process chamber is controllable by varying the number of magnetic poles of said magnetic segments.

16. A magnetic field generator as claimed in claim 15,
5 characterized in that a portion of said plurality of magnetic segments is rotatable and the number of magnetic poles of said multi-pole magnetic field segments is variable.

17. A magnetic field generator as claimed in claim 15,
10 characterized in that said plurality of magnetic segments are dismountable and in that the number of magnetic poles of said multi-pole magnetic field is decreased by dismounting a portion of said plurality of magnetic segments.

18. A magnetic field generator as claimed in any of claims 15 to
15 17, characterized in that a magnetic field control member is provided with between said magnetic segments and said process chamber for controlling the state of said multi-pole magnetic field in said process chamber.

19. A magnetic field generator as claimed in any of claims 15 to
20 18, characterized in that said magnetic field generator comprises an upper ring-shaped magnetic field generating mechanism and a lower ring-shaped magnetic field generating mechanism, and each of the upper and lower ring-shaped magnetic field generating mechanisms is provided with the magnetic segments, and in that each of the upper and lower ring-shaped
25 magnetic field generating mechanisms are arranged to move to vertically opposite directions to each other.